December 15, 1864.

J. P. GASSIOT, Esq., Vice-President, in the Chair.

A letter addressed to the President by Dr. William Farr, F.R.S., was read, as follows:—

General Register Office, Somerset House,
Dec. 2, 1864.

My dear Sir,—The Registrar-General requests that you will do him the favour to present the accompanying copy of the English Life Table to the Royal Society.

It contains some work by Scheutz's Machine, on which a Committee of the Royal Society reported; and the Table is the first national Table which has been constructed, except one for Sweden.

The method I employed I described in the paper which you did me the honour to print in the Transactions. I have extended the method, and have described its application to life and other risks.

I am, &c.,
W. Farr.

The President of the Royal Society.

The following communications were read:—

I. "On the production of Diabetes artificially in animals by the external use of Cold." By Henry Bence Jones, M.D., F.R.S. Received November 16, 1864.

In 1789 Lavoisier wrote:—"La respiration n'est qu'une combustion lente de carbone et d'hydrogène qui est semblable en tout à celle qui s'opère dans une lampe ou dans une bougie allumée; et sous ce point de vue les animaux qui respirent sont des véritables corps combustibles qui brûlent et se consument."

The different degrees of oxidation of different substances in the different parts of the body at different times, forms still, and will long continue to form, one of the largest and most important parts of the animal chemistry of health and of disease.

Notwithstanding all that Professor Liebig has done, the knowledge of the phenomena of oxidation in the body is only at its commencement. Take, for example, a grain of starch. It enters into the body, becomes sugar, is acted on by oxygen, and ultimately passes out as carbonic acid and water. This is the final result of the perfect combustion; but what are the different stages through which the starch passes? what happens if the oxidation stops at any of these stages—that is, when imperfect combustion occurs?

The combustion may be made imperfect in at least three different ways: —First, by insufficient oxygen. Secondly, by overwhelming fuel. Thirdly, by reducing the temperature so low that chemical action is checked.

From each of these causes the following scale of the combustion of starch in the body may be formed.

When there is perfect combustion, then carbonic acid and water are produced. With less perfect combustion, oxalic and other vegetable acids are formed. With the least possible combustion sugar results.

Between perfect combustion and the most imperfect combustion (that is, between carbonic acid and sugar) there are probably many steps, formed by many different acids; and as in a furnace one portion of the coal may be fully burnt, whilst other portions are passing through much less perfect combustions, or are not burnt at all, so different portions of starch may reach different steps in the scale of combustion, and sugar, acetic acid, oxalic acid, carbonic acid, and many other acids between acetic and oxalic acid may be simultaneously produced.

From this account of the oxidation of starch, it follows that sugar should always be found in the urine whenever any of the three causes mentioned reduce the oxidation in the system to its minimum. In other words, by stopping the combustion that occurs in the body, diabetes should be produced artificially.

It has long been known that an excess of sugar taken into the blood by injection causes temporary diabetes. This is imperfect combustion from excess of the combustible substance.

The diabetes of old age, of pregnancy, and after the inhalation of chloroform, may be considered as arising from imperfect combustion in consequence of a deficiency of oxygen. Bernard's diabetes from injury of the floor of the fourth ventricle probably belongs to this cause.

The third mode of checking the chemical actions in the body is by reducing the temperature. This has not yet been proved to cause diabetes, though it ought as surely to stop oxidation as excess of fuel or insufficiency of oxygen.

The simplest experiment consists in placing an animal in ice. The cold soon deprives it of feeling, and perfect insensibility is produced. My friend Dr. Dickinson undertook to give me the urine of rabbits before they were placed in ice, and after they had died from the effect of the cold.

Experiment 1.—This lasted one hour and twenty-three minutes. The cold was very carefully applied; fresh ice was added from time to time. The temperature in the rectum fell from 103° F. to 73° F. In the liver immediately after death the temperature was 76° F. The urine made immediately before the application of cold gave no perceptible trace of sugar with sulphate of copper and liquor potassæ. The urine collected after death gave marked reduction with these reagents, and when boiled with liquor potassæ alone it deepened in colour. The acid reaction also was distinctly more

marked in this urine than in that made before the application of cold. The total quantity of urine obtained after death was between two and three drachms.

Experiment 2.—This lasted seven hours and a half, in consequence of an interruption caused by the melting of nearly all the ice surrounding the rabbit. The temperature fell from 101° F. in the mouth to 69° F. after death. The urine made before the application of cold contained no sugar. The quantity of urine obtained after death was so small that I was unable to prove to my own satisfaction that sugar was present in it.

Experiment 3.—This lasted four hours and five minutes. The temperature at the commencement was 101° F. in the mouth. The urine made before the icing was alkaline from fixed alkali. It did not give any trace of sugar, and when mixed with yeast and put in a warm place it rapidly putrefied. Its specific gravity was 1014. The urine obtained after death was strongly acid, and contained crystals of oxalate of lime. It gave a plentiful reduction of oxide of copper when boiled with sulphate of copper and liquor potassæ. When boiled with liquor potassæ alone, it deepened markedly in colour. When mixed with yeast it quickly fermented most distinctly. The specific gravity was 1020.

I sent my results to Professor Brücke, and I asked him to repeat my experiments, and I have received from him the following account written in June 1864.

"The urine of rabbits always shows small quantities of sugar. No regimen could make it disappear entirely. Hay, grass, carrots; hay and grass mixed, and absolute fasting were tried, but all showed traces of sugar in the urine.

"The quantity of urine obtained was too little to allow of the fermentation test being successful, but by using the lead process, the potash, the bismuth, and the copper test gave very feeble evidence of sugar. The experiments agreed so well, that I can have no doubt that sugar is always present. The rabbit proved to be pregnant, and as I had found that in the last stage of pregnancy sugar is often increased in the urine, I thought this might account for the sugar in the urine; so I took a strong male rabbit, and then again I found that traces of sugar occur normally in the urine of rabbits as in the urine of man.

"Then I repeated your experiment. Notwithstanding what I had found, the results were striking. The quantity of sugar in the urine after freezing was incomparably greater (war ganz unvergleichlich gross).

"The urine after freezing differed also from the urine of health in the fact that, after precipitating with acetate of lead and filtering, the clear fluid gave a very small precipitate with basic acetate of lead; but on the addition of ammonia, a plentiful white precipitate fell and deposited itself, leaving the fluid clear.

"I have not made any quantitative experiments; they are not much to be

trusted, and the difference between the urine of rabbits killed by cold and all other rabbit's urine is so great that it is most distinctly perceptible (auf das Entschiedenste fühlbar) without any quantitative experiments."

II. "On the Action of Chloride of Iodine upon Organic Bodies." By Maxwell Simpson, M.B., F.R.S. Received November 22, 1864.

In a former communication * I stated to the Society that chloride of iodine combines directly with ethylene and propylene gases. I have since ascertained that it also directly combines with those radicals which are at the same time both mono- and tri-atomic. Iodide of allyle and bromide of aldehydene, having the desired atomicity, were the bodies I selected for my experiments.

Action of Chloride of Iodine on Iodide of Allyle.—In order to determine the union of these bodies, it was simply necessary to mix and agitate them. The chloride of iodine used was in the form of a watery solution. During the agitation the mixture became warm, and assumed a dark colour from the liberation of iodine. To complete the reaction, it was gently heated over the lamp for a short time. By these means a dark oily liquid was obtained, which was separated from the excess of chloride of iodine, washed with dilute potash, then with pure water, and distilled. Almost the entire liquid passed over between 190° and 215° Cent. The fraction distilling between 205 and 210 being very considerable in quantity, was collected separately and analyzed, having been previously decolorized by agitation with mercury. The numbers obtained correspond sufficiently well with the formula $C_6 H_5 Cl_2 I$, as will be seen from the following Table :—

	Theory.		Experiment.
		Per cent.	
C_6	36·00	15·06	15·49
H_5	5·00	2·09	2·25
Cl_2	71·00	29·70	..
I	127·00	53·15	..
	239·00	100·00	

The excess of carbon is accounted for by the slight decomposition suffered by the liquid during distillation, which was evidenced by the liberation of iodine.

This body I propose to call iodo-bichlor-allyle. It is a colourless oil, is insoluble in water, and has a sweet and biting taste. The following equation will explain the reaction which generates this body ; it is a case of addition and double decomposition, $C_6 H_5 I + 2 Cl I = C_6 H_5 Cl, Cl I + I I$. One equivalent of chloride of iodine converts, by double decomposition, the

* Proceedings, vol. xii. p. 278.